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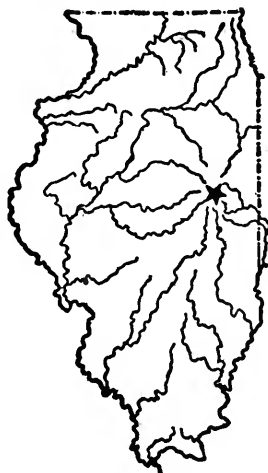
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UNIVERSITY OF ILLINOIS
Agricultural Experiment Station

BULLETIN No. 218

THE PRUNING OF WINTER-INJURED
PEACH TREES

By A. J. GUNDERSON



URBANA, ILLINOIS, MAY, 1919

SUMMARY OF BULLETIN No. 218

INTRODUCTION.—Unusually low temperatures of the winter of 1917-18 caused serious injury to peach trees in southern Illinois, and peach growers were at a loss to know how their trees should be treated, especially with reference to pruning. Page 383

EFFECTS OF WINTER INJURY.—Trees which had been planted one year showed less injury than older trees. The injury included the killing of fruit buds and injury to trunks and branches. Little root injury was observed. Discoloration of the inner wood varying from light to dark brown was the principal internal symptom. Page 383

FACTORS AFFECTING SEVERITY OF INJURY.—Trees devitalized by borers, gummosis, and starvation suffered serious winter injury. Those located in the lower parts of the orchards showed more injury than those on higher parts. Page 385

VARIETIES INJURED.—Observations of Hale trees showed more serious wood injury among them than among Elbertas. Page 385

EXPERIMENTAL PROJECT.—Experimental work was confined to Elbertas. On three-, four-, and five-year-old trees, moderate pruning gave the best results from the standpoint of size, shape, and openness of the trees and in the number of vigorous fruit buds formed on strong wood. Dehorning trees of these ages proved a poor practice. It reduced the size of the trees and in the case of the five-year-old Elbertas in the Voris orchard, killed the trees. No pruning at all gave better results than the dehorning of three-, four-, and five-year-old Elbertas. Waxing the cut surface of dehorned trees was of no value. Nitrate of soda applied at the rate of one pound per tree increased the amount and color of the foliage on moderately pruned four-year-old Elbertas and on check trees, but was of little value on dehorned trees of this age and variety. Page 386

Discoloration of the inner wood is not an absolute indication of the inability of trees to recover from the effects of winter injury. In the orchards studied, in most cases in which discoloration had resulted from the winter injury of 1917-18, new sapwood was observed the following November. The heartwood and pith of trunks and branches showed a "punky" or decomposed condition. Page 394

THE PRUNING OF WINTER-INJURED PEACH TREES

BY A. J. GUNDERSON, ASSOCIATE IN HORTICULTURE

INTRODUCTION

Unusual and prolonged periods of low temperature in southern Illinois during the winter of 1917-18 resulted in serious injury to peach trees. The month of December, 1917, was the most severe month in the climatological history of the state. In many peach-growing localities of southern Illinois the temperature reached as low as -20° and -25° Fahrenheit. During the periods of low temperature strong winds prevailed. Fortunately, however, there was a good covering of snow in most peach orchards, and therefore the injury was confined to the trunks and the branches of the trees.

Peach growers were at a loss to know how their trees should be treated, especially with reference to pruning. Some were pruning their trees severely, while others were pruning moderately. The writer recommended moderate pruning for both old and young peach trees, as experimental evidence had indicated that for winter-injured peach trees more than one year old moderate pruning was better than severe pruning.¹ In the case of June-budded or small yearling trees planted during the fall of 1917, however, it was recommended that the usual cutting back to whips be practiced.

EFFECTS OF WINTER INJURY

Winter injury to peach trees in Illinois during the winter of 1917-18 included the killing of the fruit buds and injury to wood of different ages, varying from a slight injury to the tissues to severe injury and subsequent death of the trees. In most cases trees which had been planted but one year showed less injury than older trees.

INTERNAL SYMPTOMS OF WINTER INJURY

The internal symptoms of winter injury appeared in the form of discoloration of the heartwood and sapwood, varying in color from light to dark brown (Figs. 1 and 2). The cambium layer turned a pale, watery green. The odor of the cell sap was sour, suggesting fermenta-

¹Mass. (Hatch) Agr. Exp. Sta. Rpt. 1905, p. 167.
U. S. Dept. Agr. Bur. Plant Indus. Bul. 51, part III.
N. Y. (Geneva) Agr. Exp. Sta. Bul. 269.

tion. These conditions were present in the trunk and the branches. The roots of the trees in every peach orchard examined remained normal, owing to the protection afforded by the heavy covering of snow (Fig. 3).

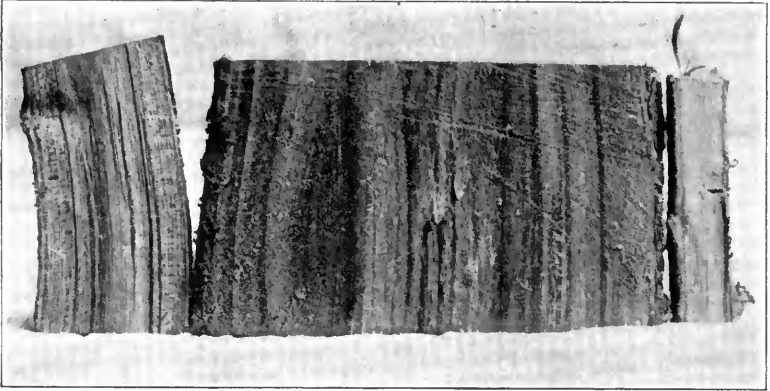


FIG. 1.—LONGITUDINAL SECTION OF BRANCH AND TRUNK OF FIVE-YEAR-OLD
ELBERTA

Note the discoloration of the wood of the trunk in comparison with the healthy uninjured wood of the small branch at the right.

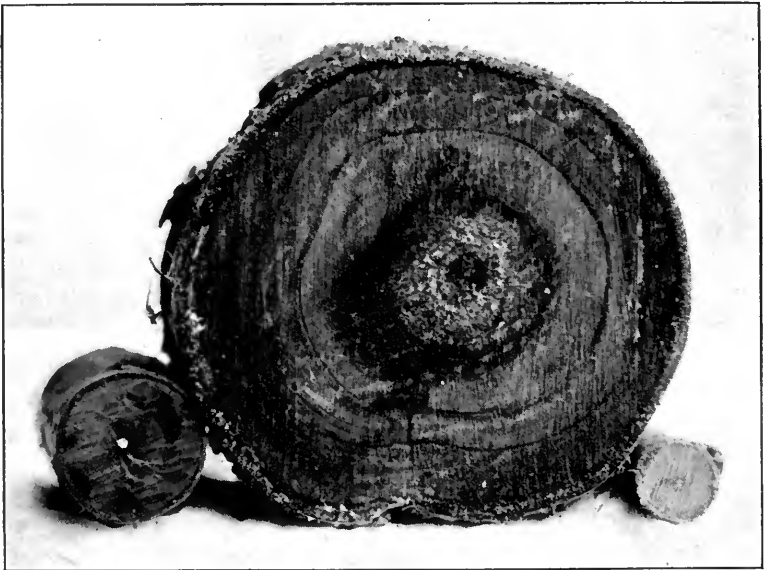


FIG. 2.—CROSS-SECTION OF BRANCH AND TRUNK OF FIVE-YEAR-OLD ELBERTA

Note the discoloration of the wood of the trunk in comparison with the healthy, uninjured wood of the small branch at the right.

EXTERNAL SYMPTOMS OF WINTER INJURY

The first external symptoms of winter injury appeared in the form of shrunken bark on which the lenticles stood out prominently, giving the bark a slightly roughened appearance; and also in some cracking or splitting of the tree trunks. A later symptom was noted in which the leaf buds expanded, owing to the local supply of stored food, but finally wilted on account of the inability of the injured tissues to conduct sap from the roots. This type of injury appeared both on single branches and on entire trees.

FACTORS AFFECTING SEVERITY OF INJURY

The amount of winter injury to peach orchards in southern Illinois varied not so much with latitude, for the low temperatures were quite uniform, as with differences in vigor and healthiness of the trees, elevation of the orchard, and age of the trees. Trees devitalized as the result of previous injury from borers, gummosis, and lack of proper feeding and cultivation were most severely injured and in many cases died. Those located on well elevated and properly drained soil showed less serious injury than those situated on level land or in "pockets." In some cases a difference of a few feet in elevation within the same orchard caused a marked difference in the severity of the injury. Trees which had been planted one year appeared to be injured less than older trees.

VARIETIES INJURED

Little opportunity was afforded to study winter injury on any variety of peach trees other than Elberta and Hale. The former variety is the most important one grown commercially in southern Illinois, while the latter is being planted to some extent. It

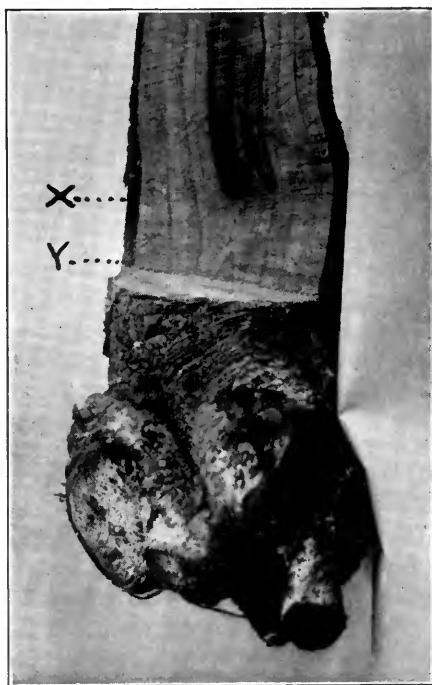


FIG. 3.—HORIZONTAL SECTION OF ELBERTA TREE

Note the discoloration of wood beginning at the snow-line (X) as compared with the uninjured wood at Y, below the snow-line.

has been thought by certain peach growers of other states that Hale is more resistant to low temperatures in the bud than is Elberta, but in southern Illinois, during the winter of 1917-18, both varieties proved failures in this particular. Hale is a less thrifty grower than is Elberta in this section of the state and following the winter of 1917-18 showed as much, and in certain cases more, serious wood injury.

EXPERIMENTAL PROJECTS

As serious winter injury to the wood of peach trees rarely occurs in southern Illinois, advantage was taken of the opportunity offered at this time to conduct investigations with the view of determining a satisfactory way of handling such trees. Experimental work was confined to the Elberta variety.

VORIS ORCHARD, NEOGA, CUMBERLAND COUNTY

In the spring of 1918, the entire Voris peach orchard at Neoga showed serious winter injury, with some dead trees in the lowest parts. The trees were five-year-old Elbertas which had, up to that time, received fairly good care. They stood on level to undulating gray silt loam soil.

Four rows of trees containing seven in each row were selected and pruned as follows on March 28, when the leaf buds had started:

- Row 1. One-half of the previous year's wood was removed.
- Row 2. Dehorned to within eighteen inches to two feet of the trunks, the one-, two-, and three-year-old wood being removed. Three trees were waxed at the cut surfaces and four left unwaxed.
- Row 3. Check. Unpruned.
- Row 4. From four trees all the previous year's wood was removed. Three trees were pruned leaving four inches of the previous year's wood.

Judging from the discoloration of the wood of all the trees in this experiment, the injury was very severe. In Row 2 the wounds of three of the trees were waxed immediately after dehorning, while four trees were left unwaxed with the view of determining whether or not the checking of evaporation would aid recovery.

On July 23, observations were made upon the relative condition of the trees. The trees in Rows 1 and 4 were the best from the standpoint of growth and amount and color of the foliage. The check or unpruned trees were making a straggling growth and presented an unthrifty appearance. All the trees in Row 2, which had been dehorned, were practically dead, with the exception of one unwaxed tree. It may be concluded, therefore, that evaporation at the cut surfaces of the dehorned trees was not directly responsible for their death. The dehorning of these trees resulted in an extreme reduction in the amount of leaf surface with a corresponding reduction in amount of transpiration. As it is quite probable that transpiration in peach trees

exerts some effect upon the flow of sap, it seems likely that the trees of Row 2 did not draw a sufficient amount of sap from their roots to sustain them and permit growth. Then, too, the season was extremely hot and dry.

On October 29, observations were again made to ascertain the condition of the trees in the different rows. In Row 2 only one tree remained alive, one which had been left unwaxed. It had made the usual heavy growth characteristic of dehorned peach trees and carried practically no fruit buds. The trees in Rows 1 and 4 had an abundance of fruit buds present on strong wood. The unpruned trees in Row 3 showed plenty of fruit buds, but they were borne on small, weak branches.

POFF ORCHARD, OLNEY, RICHLAND COUNTY

The Poff peach orchard at Olney showed a variable degree of winter injury following the winter of 1917-18. That part of the orchard well elevated and properly drained consisted of four-year-old Elbertas. The rest of the trees, situated on more level and lower ground, were three-year-old Elbertas, which seemed to show slightly more serious injury than the four-year-old trees on the higher ground. The soil of this orchard is yellow gray silt loam.

Series 1: Three-Year-Old Elbertas

Four rows containing five three-year-old Elberta trees each were pruned in the following manner on March 26, when the leaf buds were out:

- Row 1. Pruned moderately; previous year's growth clipped approximately one-half.
- Row 2. Dehorned, the one- and two-year-old wood removed.
- Row 3. One-year-old wood removed.
- Row 4. Check. Unpruned.

On May 12, the trees of Rows 1 and 3 were making the best growth and carrying the best colored foliage. The trees in Row 2, which had been dehorned, were growing slowly but had good foliage. The unpruned trees were making the poorest growth and carried sickly, yellow leaves.

On July 9, the trees in Row 3, from which all of the previous year's wood had been removed, had made the greatest amount of growth, while the trees in Row 1, the one-year-old wood of which had been clipped, were second, with the trees in Row 2, which had been dehorned, and those of Row 4, which had been left unpruned, following in amount of growth. Trees which had been dehorned were very dense and were reduced so low that much of the growth lay on the ground, and was therefore useless so far as its ability to carry

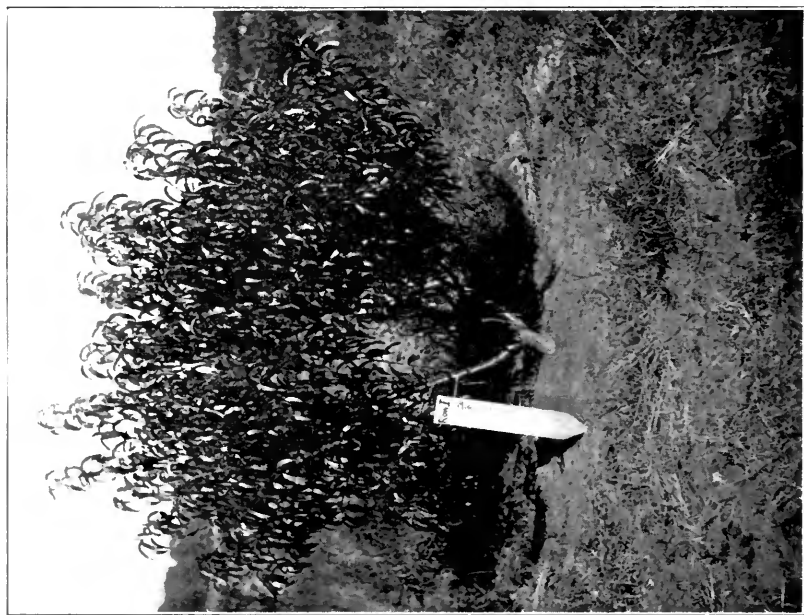


FIG. 4.—SERIES 1, ROW 1: THREE-YEAR-OLD ELBERTA
Pruned moderately. Previous year's wood clipped.

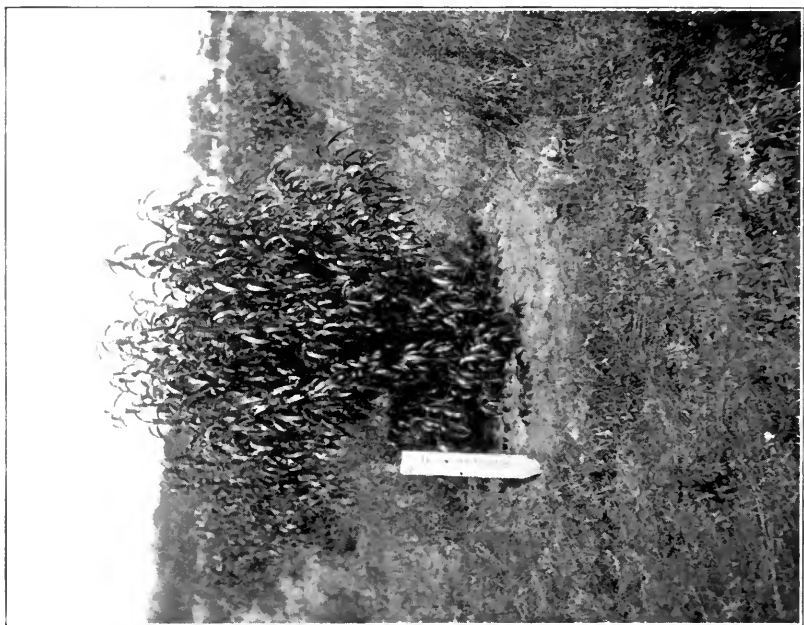


FIG. 5.—SERIES 1, ROW 2: THREE-YEAR-OLD ELBERTA
Dehorned, one- and two-year-old wood removed.

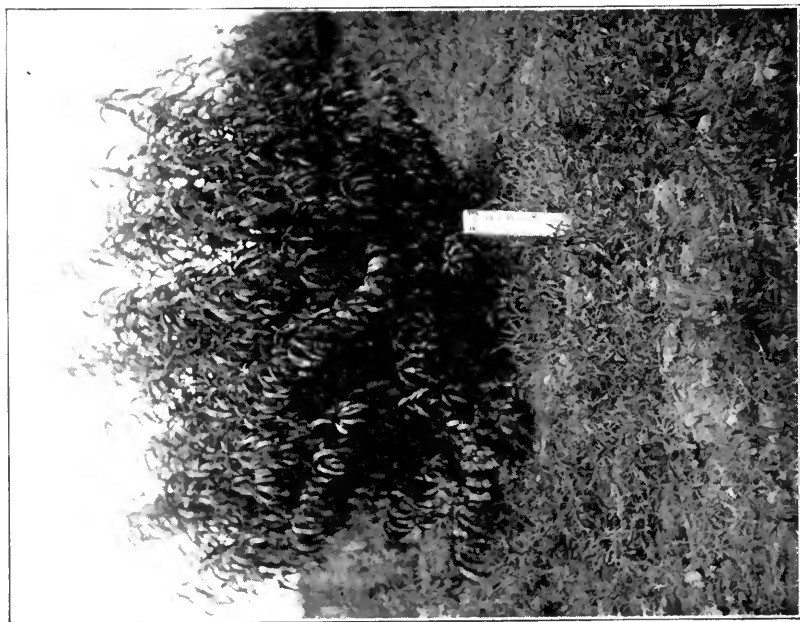


FIG. 6.—SERIES 1, ROW 3: THREE-YEAR-OLD ELBERTA
One-year-old wood removed.

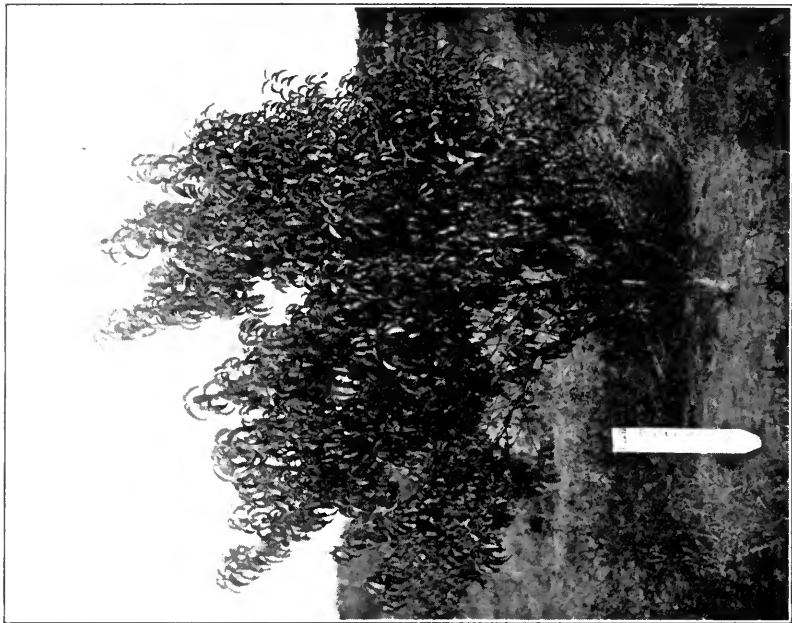


FIG. 7.—SERIES 1, ROW 4: THREE-YEAR-OLD ELBERTA
Check. Unpruned.

fruit-bearing wood in the future was concerned. In Figs. 4 to 7 one tree from each of the four rows is shown.

On October 30, when most of the leaves had fallen, observations were made to determine the relative amounts of fruit-bud formation on the trees of the different rows. The greatest number of fruit buds had developed in Row 1, the trees whose one-year-old wood had been clipped; the next greatest number was on the trees in Row 4, which had not been pruned, while a smaller number of buds was present on the trees in Row 3, from which the one-year-old wood had been removed. Row 2, the trees of which had been dehorned, developed practically no fruit buds, owing to the very heavy primary growth that resulted from the severe pruning.

The fruit buds on the trees of Rows 1 and 3, which had been moderately pruned, were carried on strong growth, while those on the unpruned trees in Row 4 developed on small, weak branches.

Series 2: Four-Year-Old Elbertas

Five rows of trees, each containing five four-year-old Elbertas, were pruned in the following manner on March 26, when the leaf buds were out:

- Row 1. Pruned moderately, previous year's growth clipped approximately one-half.
- Row 2. Dehorned, the one-, two-, and three-year-old wood removed.
- Row 3. One-year-old wood removed.
- Row 4. Dehorned, the one- and two-year-old wood removed.
- Row 5. Check. Unpruned.

On April 1, one pound of nitrate of soda was applied broadcast to three trees in each row for the purpose of studying the effects of this fertilizer on the recovery of the trees from winter injury.

On May 12, the trees in Rows 1 and 3 were making a better type of growth than those in Rows 2 and 4. The unpruned trees in Row 5 were making weaker growth at this time.

The foliage of the trees which had received the nitrate of soda was heavier and of a darker green color than that of the untreated trees. This difference was much more apparent, however, in the check and the moderately pruned trees than in those dehorned. This was probably due to the fact that heavy pruning of peach trees usually results of itself in the stimulation of a heavy growth of wood and foliage, especially when the trees are in vigorous condition.

On July 9, the rankest growth had been made by the trees in Rows 2 and 4. The tops were very dense and were reduced so low that many of the branches lay on the ground, making it necessary to remove them later. The trees which were making the most desirable growth from the standpoint of amount and spread were those in Row

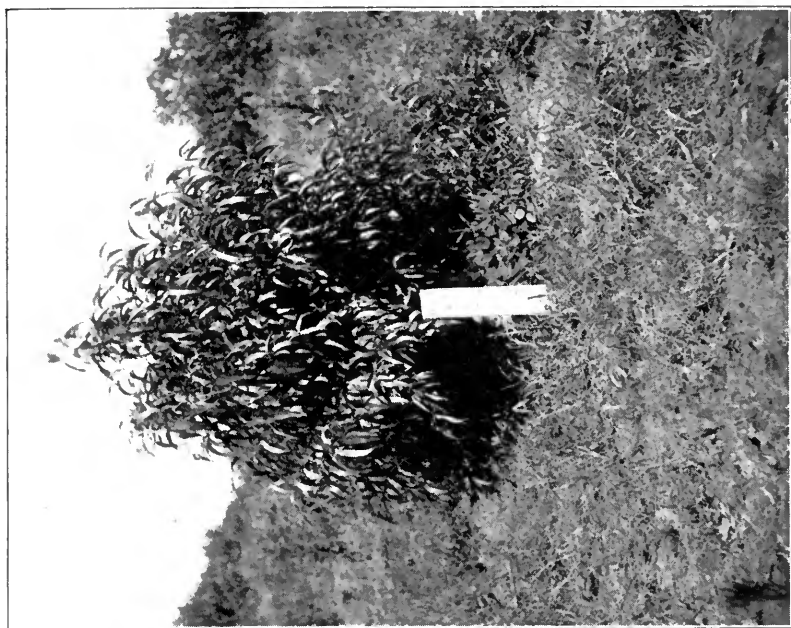


FIG. 9.—SERIES 2, ROW 2: FOUR-YEAR-OLD ELBERTA Dehorned, one-, two-, and three-year-old wood removed.

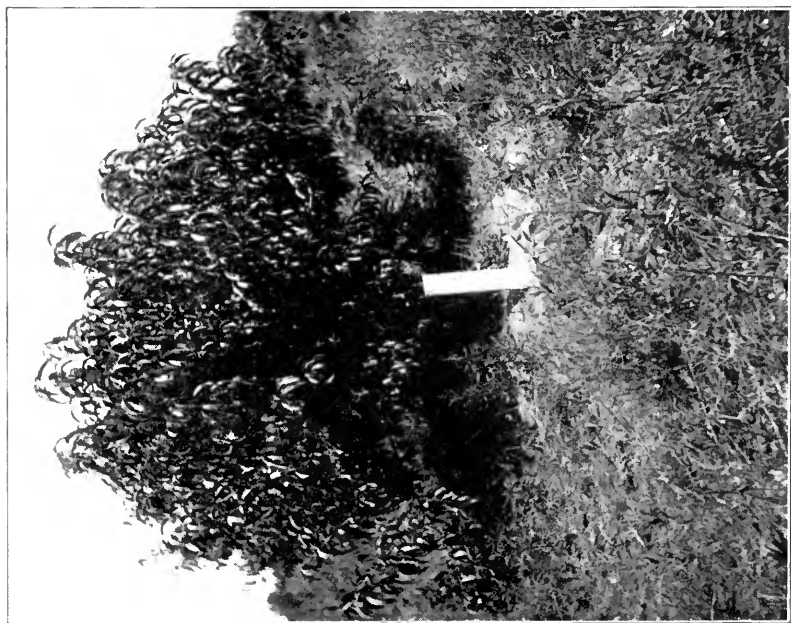


FIG. 8.—SERIES 2, ROW 1: FOUR-YEAR-OLD ELBERTA Pruned moderately. Previous year's wood clipped.

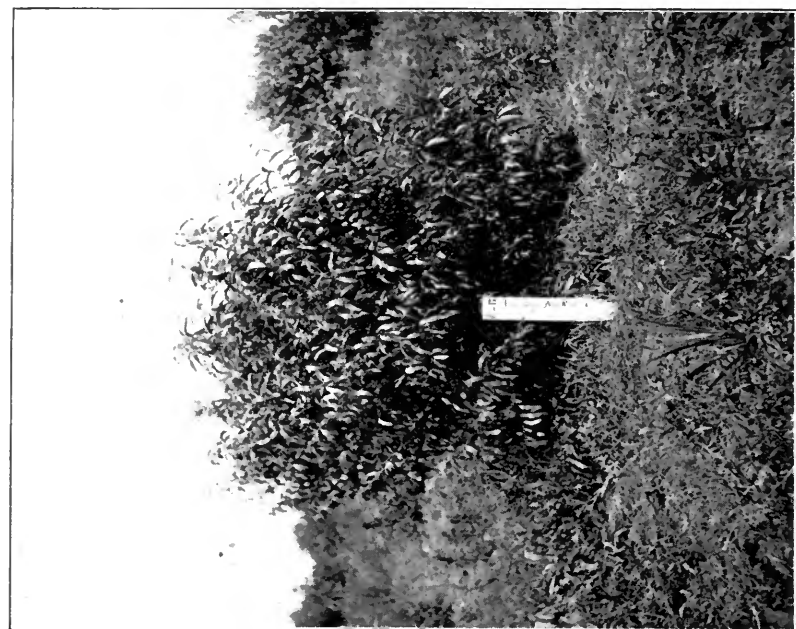


FIG. 11.—SERIES 2, ROW 4: FOUR-YEAR-OLD ELBERTA
Dehorned, one- and two-year-old wood removed.

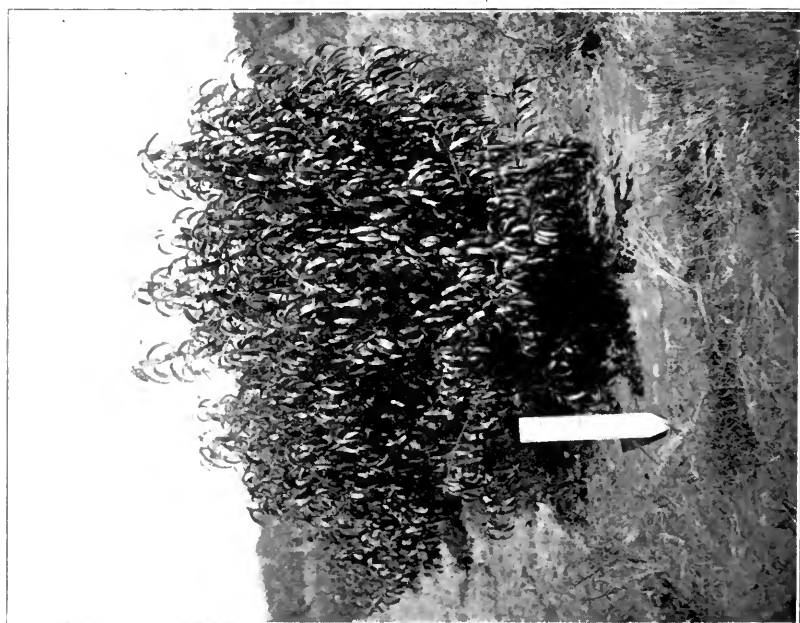


FIG. 10.—SERIES 2, ROW 3: FOUR-YEAR-OLD ELBERTA
One-year-old wood removed.



FIG. 12.—SERIES 2, ROW 5: FOUR-YEAR-OLD ELBERTA
Check. Unpruned.

1, whose one-year-old wood had been clipped one half. The next best trees were those in Row 3, from which the one-year-old wood had been entirely removed. The unpruned trees were better than those dehorned, from the standpoint of both size and shape.

The effects of the nitrate of soda were still noticeable on the check trees and on the trees which had been moderately pruned.

Observations were made October 30 on the relative amount of fruit-bud formation on the trees in the different rows. The trees in Row 1, whose one-year-old wood had been clipped, carried the largest number of well distributed, vigorous fruit buds and on wood of desirable size. The unpruned trees carried a large number of less plump but well distributed fruit buds on small-sized branches. The trees in Row 3, from which the one-year-old wood had been removed entirely, had a good many poorly distributed fruit buds carried on wood that was a little too heavy to be desirable. The tops of the trees in this row were so dense as to require considerable thinning of the branches and consequent removal of many fruit buds.

Very few fruit buds were present on the dehorned trees in Rows 2 and 4. This was due to the fact that, as usual on severely pruned trees, long and heavy primary growth of branches developed, on which relatively few fruit buds ever appear.

INTERNAL APPEARANCE OF WOOD TISSUES AT THE END OF THE GROWING SEASON

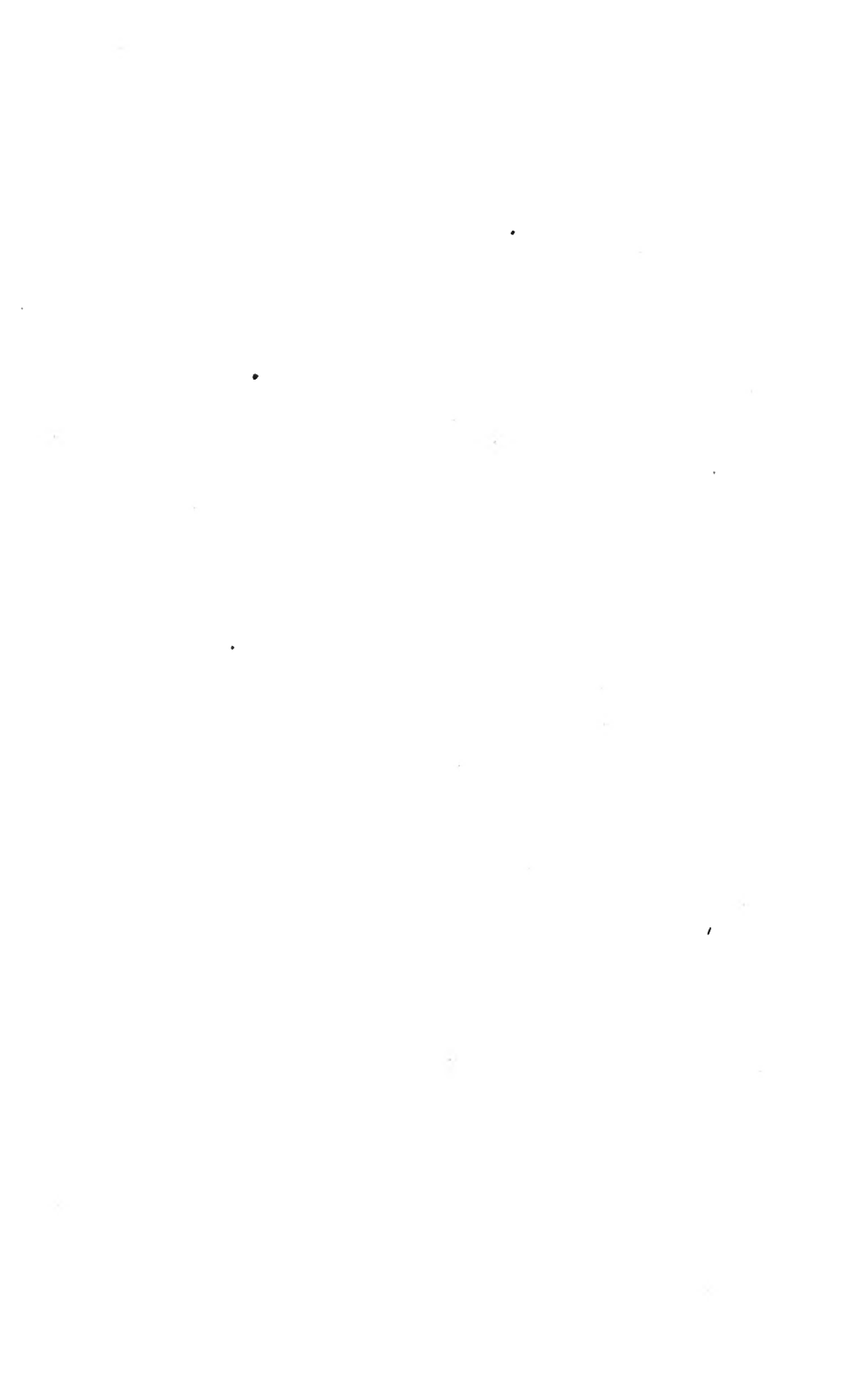
Examination of the internal tissues of the wood of both branches and trunks was made in both experimental orchards during November after the growing season had ended. It was observed that a new layer of sapwood had been formed, of greater thickness in the trunks of the trees than in the branches (Fig. 13). The heartwood and pith had assumed a "punky" condition, suggesting decomposition. Whether such a condition will eventually prove detrimental to the productiveness and vigor of the trees remains to be seen.



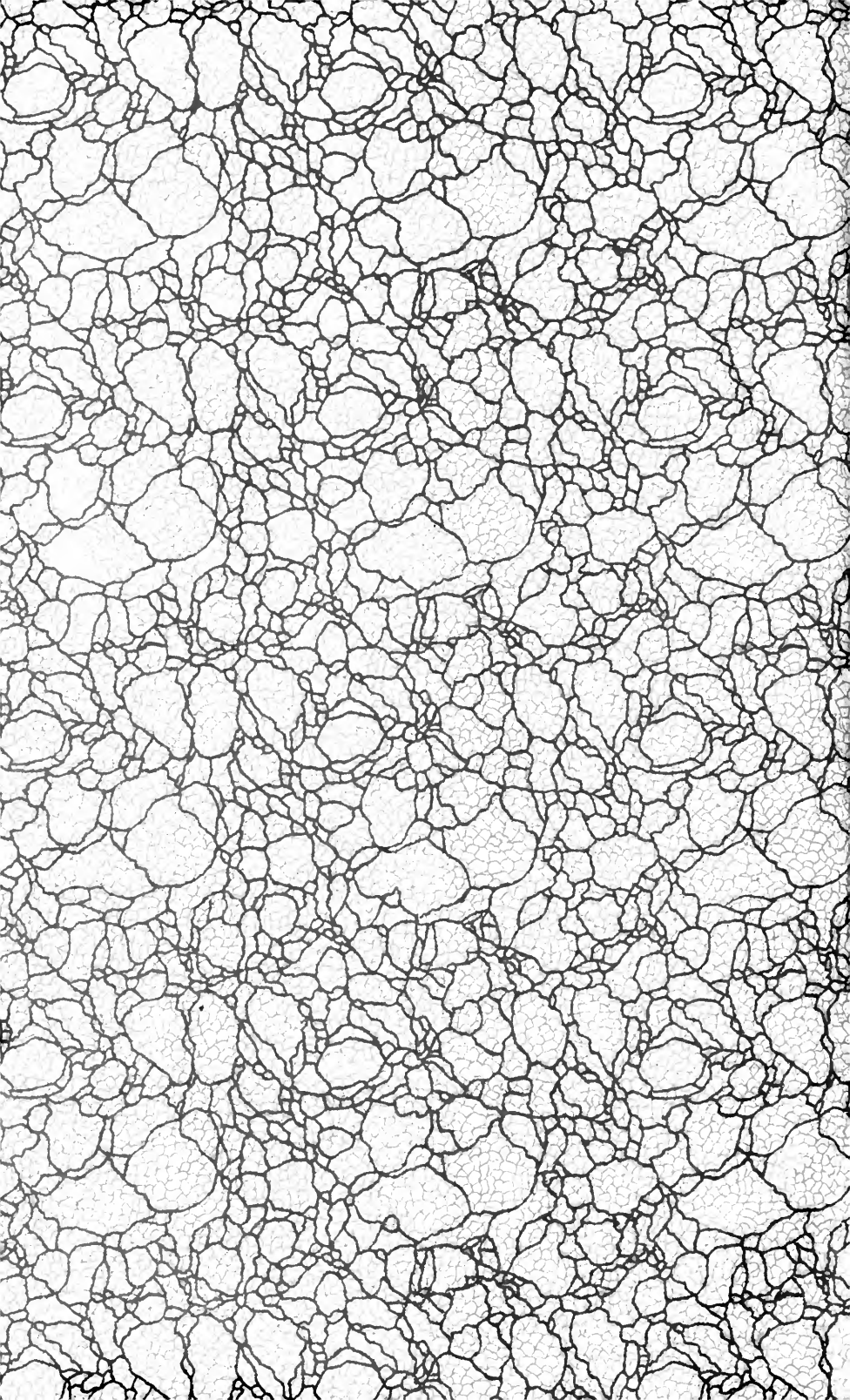
FIG. 13.—CROSS-SECTION OF BRANCH AND TRUNK OF THREE-YEAR-OLD ELBERTA
MADE ON NOVEMBER 15, 1918

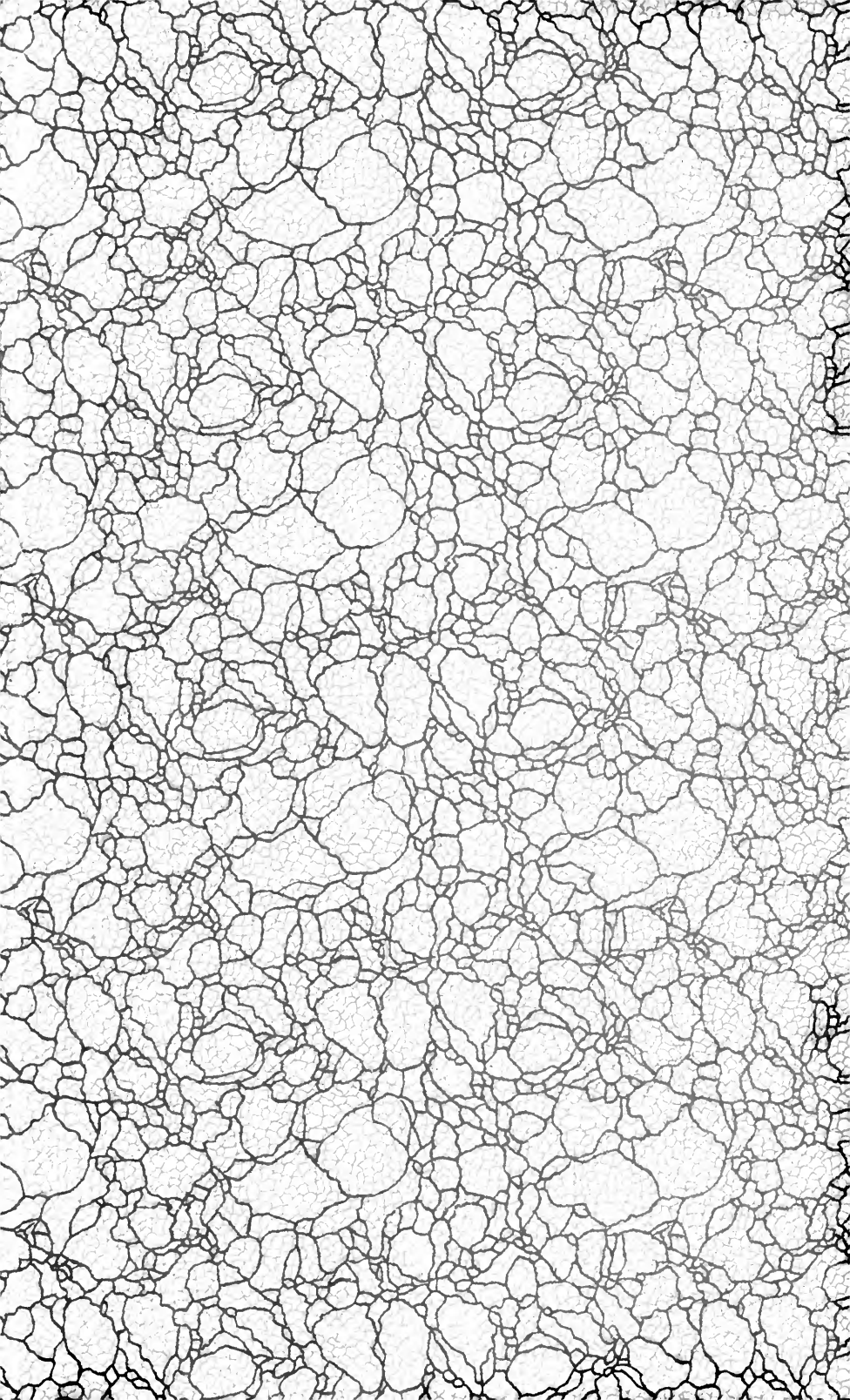
Note the "punky" condition of the pith and heartwood; also the new ring of sapwood formed around the injured tissues.











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